

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 19 October 2000 (19.10.00)	
International application No. PCT/GB00/00725	Applicant's or agent's file reference 07 35544
International filing date (day/month/year) 01 March 2000 (01.03.00)	Priority date (day/month/year) 04 March 1999 (04.03.99)
Applicant MULLINS, Dennis, Roy et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
04 October 2000 (04.10.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer S. Mafla Telephone No.: (41-22) 338.83.38
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PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 07 35544	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 00/ 00725	International filing date (day/month/year) 01/03/2000	(Earliest) Priority Date (day/month/year) 04/03/1999
Applicant ICO SERVICES LTD.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (see Box II).

4. With regard to the title,

☐ the text is approved as submitted by the applicant.

☒ the text has been established by this Authority to read as follows:

NEIGHBOURING CELL LIST GENERATION IN A MOBILE SATELLITE COMMUNICATION SYSTEM

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

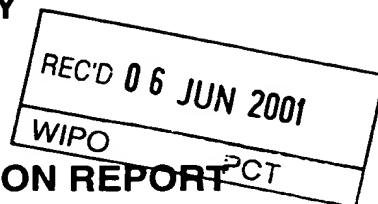
1
☐ None of the figures.

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PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



2

Applicant's or agent's file reference 07 35544	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB00/00725	International filing date (day/month/year) 01/03/2000	Priority date (day/month/year) 04/03/1999
International Patent Classification (IPC) or national classification and IPC H04B7/185		
Applicant ICO SERVICES LTD.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 6 sheets, including this cover sheet.

- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 04/10/2000	Date of completion of this report 31.05.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer Bischof, J-L Telephone No. +31 70 340 2607 

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00725

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-12 as originally filed

Claims, No.:

1-9 as originally filed

Drawings, sheets:

1/7-7/7 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00725

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	2-5,7-9
	No:	Claims	1,6
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-9
Industrial applicability (IA)	Yes:	Claims	1-9
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

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**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/00725

The examination is being carried out on the application documents as originally filed.

The following document has been considered for the purposes of this report:

D1: WO-A-96/13946 (Motorola).

The closest state of the art is represented by D1.

1. The present application does not meet the requirements of Article 33(2) PCT, because the subject-matter of independent claims 1 and 6 is not new in respect of prior art as defined in the regulations (Rule 64(1)-(3) PCT).

- 1.1. D1 discloses a method of operating a mobile station in a satellite mobile telephone system (see figure 2), the method comprising the steps of:

decoding all of a set of neighbouring cell data transmitted in a broadcast channel (see page 8, lines 2-4 and lines 11-12) to generate a neighbouring cell list (see page 11, lines 20-24 and see figure 6);

making signal measurements for the cells in said list and the current serving cell (see page 9, lines 25-36);

decoding a portion only of the set of neighbouring cell data transmitted in the broadcast channel and modifying the neighbouring cell list in dependence thereon (see page 10, lines 6-12);

and making signal measurements for the cells in said list and the current serving cell (see page 9, lines 25-36).

The subject-matter of independent claim 1 is therefor not new (Article 33(2) PCT).

- 1.2. The subject-matter of claim 6 is not new because this claim refers to claim 1 which is not new and does not contain any additional subject-matter.
2. The present application does not meet the requirements of Articles 33(3) PCT, because the subject-matter of claims 2-5, 7-9 does not involve an inventive step

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(Rule 65(1)(2) PCT).

- 2.1. D1 discloses a method of operating a mobile satellite telephone system (see figure 2) comprising the steps of:

transmitting neighbouring cell data in a broadcast channel (see page 8, lines 2-4 and lines 11-12), the neighbouring cell data comprising a first portion relating to cells served by a first satellite in an orbit having a first plane, a second portion relating to cells served by a second satellite in an orbit having a second, different plane (see page 2, line 33 to page 3, line 12); and

transmitting neighbouring cell data in the broadcast channel (see page 9, lines 25-36 and page 10, lines 6-12).

The subject-matter of claim 7 is distinguished therefrom by the fact that the second part of the cell data is modified in dependence on the relative motion of the first and second satellites.

In a satellite system with moving satellites at lower altitude, the cells on earth are related to the motion of the satellites. The cell data are therefore related to the relative motion of the satellites.

The subject-matter of claim 7 is therefore inventive (Article 33 PCT).

- 2.2. The dependent claims do not bring any inventive subject-matter. Beacon frequency for a cell defined in dependent claims 4 and 8 are described in D1 page 9, lines 22-24.
- 3.1. The sentence "making signal measurements for the cells in said list and the current serving cell" appears twice in claim 1.
- 3.2. The present application does not meet the requirements of Article 6 PCT, because the subject-matter of claim 6 is not clear.

Claim 6 describes a mobile station and is therefore a claim of a different category of independent method claim 1 and 7. Claim 6 should have been written as an independent claim and contain all the subject-matter of a patentable method claim.

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**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/00725

- 3.3. The various definitions of the invention given in the independent method claims 1 and 7 are such that the claims are as a whole not clear and concise, contrary to Article 6 PCT. The claims should have been recast to include only the minimum necessary number of independent claims in any category, with dependent claims as appropriate.
- 4.1. To meet the requirements of Rule 5.1(a)(ii) PCT, the document D1 should have been identified in the description and the relevant background art disclosed therein should have been briefly discussed.
- 4.2. Reference signs in parentheses should have been inserted in the claims to increase their intelligibility, Rule 6.2.(b) PCT. This applies to both the preamble and characterising portion.
- 4.3. It would have been appropriate to draft the independent claims in the two part form as required by Rule 6.3(b) PCT, whereby the features known from D1 should have been placed in the preamble.

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14 APR 2000

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT
OR THE DECLARATION

(PCT Rule 44.1)

To:

VENNER, SHIPLEY & CO.
Attn. GEARY, Stuart L.
20 Little Britain
London EC1A 7DH
UNITED KINGDOM

Date of mailing
(day/month/year)

12/04/2000

Applicant's or agent's file reference

07 35544

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/GB 00/ 00725

International filing date
(day/month/year)

01/03/2000

Applicant

ICO SERVICES LTD.

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within 20 months from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Liliane Van Velzen-Peron

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NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

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NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

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PATENT COOPERATION TREATY

RECEIVED

- 4 JUN 2001

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

GEARY, Stuart L.
VENNER, SHIPLEY & CO.
20 Little Britain
London EC1A 7DH
GRANDE BRETAGNE

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing
(day/month/year) 31.05.2001

Applicant's or agent's file reference
07 35544

IMPORTANT NOTIFICATION

International application No.
PCT/GB00/00725

International filing date (day/month/year)
01/03/2000

Priority date (day/month/year)
04/03/1999

Applicant
ICO SERVICES LTD.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/



European Patent Office - P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk - Pays Bas
Tel. +31 70 340 - 2040 Tx: 31 651 epo nl
Fax: +31 70 340 - 3016

Authorized officer

Korving, J

Tel. +31 70 340-2052



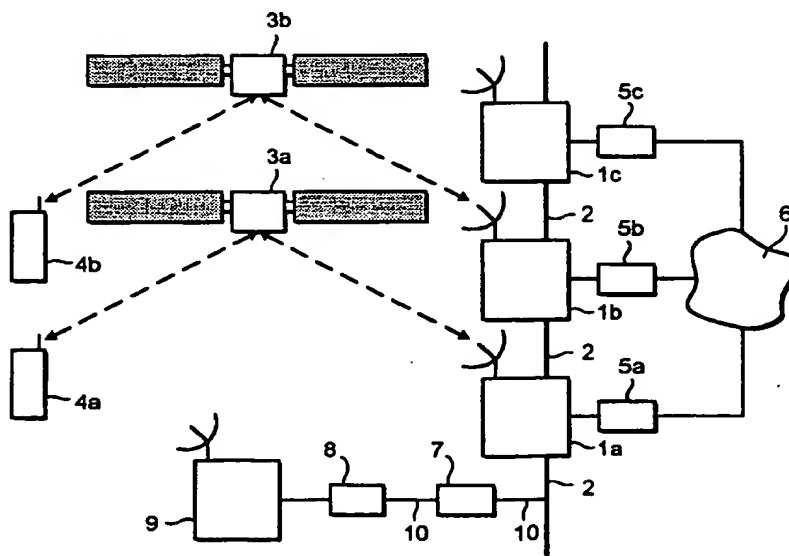
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷: H04B 7/185	A1	(11) International Publication Number: WO 00/52848 (43) International Publication Date: 8 September 2000 (08.09.00)
(21) International Application Number: PCT/GB00/00725 (22) International Filing Date: 1 March 2000 (01.03.00) (30) Priority Data: 99301632.8 4 March 1999 (04.03.99) EP (71) Applicant (for all designated States except US): ICO SERVICES LTD. [GB/GB]; 1 Queen Caroline Street, London W6 9BN (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): MULLINS, Dennis, Roy [GB/GB]; 23 Kennington Palace Court, Sancroft Street, London SE11 5UL (GB). GRAYSON, Mark [GB/GB]; 71 Paxton Road, Chiswick, London W4 2QT (GB). (74) Agent: VENNER, SHIPLEY & CO.; 20 Little Britain, London EC1A 7DH (GB).		(81) Designated States: JP, US. Published <i>With international search report.</i>

(54) Title: NEIGHBOURING CELL LIST GENERATION IN A MOBILE SATELLITE COMMUNICATION SYSTEM

**(57) Abstract**

The neighbouring cell data, transmitted in a broadcast control channel of a satellite mobile telephone system, is split into two parts. One part is relatively static and includes cells (301, ..., 307) served by the same satellite (3a) and cells served by satellite in the same orbit. The other part changes relatively rapidly and includes cells (401, ..., 407) served by satellites (3b) in other orbits. Supplementary data is transmitted to the mobile station (4) informing it when it needs to decode the second part of the neighbouring cell data, e.g. when there has been a significant relative movement between the footprints of two satellites (3a, 3b). A benefit of the present invention is a reduction in power consumption due to a reduction in the processing of neighbouring cell data.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
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BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
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CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakhstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

NEIGHBOURING CELL LIST GENERATION IN A MOBILE SATELLITE COMMUNICATION SYSTEM

Description

The present invention relates to a method of operating a mobile station in a mobile satellite telephone system and to a method of operating a satellite mobile telephone system.

Various proposals have been made for satellite mobile telephone systems. These include the Inmarsat-M system, the IRIDIUM™ system described in EP-A-0365885, the ICO™ system described in GB-A-2295296 and the ODYSSEY™ system described in EP-A-0510789.

A satellite mobile telephone system, in which the satellites are not in geosynchronous orbits, differs from a terrestrial mobile telephone system in that cells move relative to each other. In the case of the ICO system, described in GB-A-2295296, each satellite produces a plurality of beams, each of which corresponds to one cell of the system. The beams from one satellite do not move relative to each other. Consequently, for each cell, the neighbouring cells served by the same satellite remain the same at all times. Furthermore, the cells served by one satellite will also maintain a constant relationship with those served by another satellite following the same orbit.

However, the ICO and other systems include satellites following a plurality of different orbits. Often the cells served by a satellite in one orbit will overlap or be adjacent to cells served by another satellite. Since the satellites are in different orbits, the relationship between the cells served by one satellite and those served by another satellite in another orbit will vary with time.

Each mobile station in the network must be aware of the cells neighbouring the cell in which it is currently located when it is in idle mode. Accordingly, as in the case of GSM systems, for example, data identifying lists of neighbouring cells is transmitted in a broadcast control channel.

According to the present invention, the neighbouring cell data is split into at least two parts in the broadcast control channel. One part is relatively static and includes

cells served by the same satellite. The first part may also include cells served by satellites in the same orbit, if yaw correction is employed to stop the foot prints of the satellites rotating on the earth as the satellite orbits. However, the cells of another satellite in the same orbit could be covered by their own block of
5 neighbouring cell data. The other part changes relatively rapidly and includes cells served by satellites in other orbits. Supplementary data is preferably transmitted to the mobile station informing it when it needs to decode the relatively static neighbouring cell data. The rapidly changing data may be decoded by the mobile station each time it is transmitted or at predetermined intervals. A benefit of the
10 present invention is a reduction in power consumption due a reduction in the processing of neighbouring cell data.

Accordingly, the applicant seeks protection for a method of operating a mobile station in a satellite mobile telephone system, the method comprising the steps of:
15 decoding all of a set of neighbouring cell data transmitted in a broadcast channel to generate a neighbouring cell list; making signal measurements for the cells in said list and the current serving cell; decoding a portion only of the set of neighbouring cell data transmitted in the broadcast channel and modifying the neighbouring cell list in dependence thereon; and making signal measurements for the cells in said list and the
20 current serving cell. The form of the neighbouring cell list is not important to the present invention in its broadest aspect. It is only necessary that the neighbouring cell list be sufficient to enable to mobile station to make signal measurements for neighbouring cells.

25 A "neighbouring cell" is one that is adjacent to, overlaps, is contained within or contains the cell on which the mobile station is currently camped.

Preferably, a method according to the present invention includes the steps of decoding a further portion of said set on reception of a decode instruction in the
30 broadcast channel and modifying the neighbouring cell list in dependence thereon. The further portion preferably relates to the cells served by the same satellite.

Preferably, the neighbouring cell data comprises information identifying a beacon frequency for each cell.

5 A method according to the present invention preferably includes comparing said measurements; and if the best measurement is not for the currently serving cell, camping on the cell to which the best measurement applies. The "best" measurement may correspond to the signal with the greatest strength. However, this need not be the case. For instance, a strong signal may be subject to multi-path or co-channel
10 interference, in which cases a measure of the corruption of the received and decoded data would be a more useful measure.

The applicant also seeks protection for a mobile station for a satellite mobile telephone system, the mobile station comprising transceiver means and control
15 means, wherein the control means is programmed so as to cause the mobile station to operate according to a method embodying the present invention.

The applicant also seeks protection for a method of operating a mobile satellite telephone system comprising the steps of transmitting neighbouring cell data in a
20 broadcast channel, the neighbouring cell data comprising a first portion relating to cells served by a first satellite in an orbit having a first plane and a second portion relating to cells served by a second satellite in an orbit having a second, different plane; and transmitting neighbouring cell data in the broadcast channel, the second part of the cell data being modified in dependence on the relative motion of the first
25 and second satellites. Preferably, such a method includes transmitting a decode instruction when data in the first portion of the cell data is modified.

Preferably, the neighbouring cell data comprises information identifying a beacon frequency for each cell.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 illustrates a satellite mobile telephone system;

Figure 2 shows a mobile station;

5 Figure 3 is a schematic diagram of a satellite access node of the system of Figure 1;

Figure 4 is a data flow diagram for the system of Figure 1;

Figure 5 shows the parts of the TDMA frame structure of the system of Figure 1 that are relevant to the present invention;

10 Figure 6 shows the relative positions of the footprints of two satellites at a first instant;

Figure 7 shows the relative positions of the footprints of the two satellites at a second instant a short time after the first instant; and

Figure 8 is a flow diagram illustrating the operation of a mobile station and the network.

15

Referring to Figure 1, a satellite mobile telephone system comprises a plurality of satellite access nodes 1a, 1b, 1c interconnected by a high capacity digital network 2 (hereinafter "the backbone network"), a plurality of satellites 3a, 3b, a plurality of a mobile stations 4a, 4b, gateway mobile satellite switching centres 5a, 5b, 5c providing
20 connections between the satellite access nodes 1a, 1b, 1c and other networks 6, a network management centre 7, a satellite control centre 8 and a tracking, telemetry and control station 9. The network management centre 7, the satellite control centre 8 and the tracking, telemetry and control station 9 are interconnected by a lower capacity digital network 10 which is also connected to the backbone network 2. The
25 other networks 6 comprise the public switched telephone network (PSTN), cellular telephone networks and the like.

The satellite control centre 8 and the tracking, telemetry and control station 9 control the operation of the satellites 3a, 3b, for instance setting transmit power levels and
30 transponder input tuning, as directed by the network management centre 7.

Telemetry signals from the satellites 3a, 3b are received by the tracking, telemetry and

control station 9 and processed by the satellite control centre 8 to ensure that the satellites 3a, 3b are functioning correctly.

5 The satellites 3a, 3b repeatedly broadcast control information in broadcast control channels (BCCH). A mobile station 4a repeatedly receives and decodes the information in the BCCH broadcast by the satellite 3a, 3b currently serving it.

10 During a telephone call, a mobile station 4a, 4b communicates with a satellite 3a, 3b via a half duplex channel comprising a downlink channel and an uplink channel. The channels comprise TDMA time slots on frequencies allocated on initiation of the call or re-allocated during a call.

The satellites 3a, 3b are in non-geostationary orbits and comprise generally conventional satellites, such as the known Hughes HS601 model, and may include
15 features as disclosed in GB-A-2288913. Each satellite 3a, 3b is arranged to generate an array of beams covering a footprint beneath the satellite, each beam including a number of different frequency channels and time slots.

Referring to Figure 2, a mobile station 4 is generally similar to the units presently
20 available for GSM networks and comprises a codec, a controller 16, a microphone 10, a loudspeaker 11, a battery 12, a keypad 13, a radio frequency interface, an antenna 14, a display 15 and subscriber identification module (SIM) smart card.

25 The codec comprises a low bit-rate coder, which generates a speech bit stream at 3.6 kbits/s, together with a channel coder, which applies error correction codes to the speech bit stream to produce an encoded bit stream at 4.8 kbits/s. The low bit-rate coder is a linear predictive coder. The channel coder uses Viterbi coding. The codec also comprises complementary decoders.

30 The SIM includes a processor and a non-volatile memory which stores data identifying the subscriber and data for use in encrypted communication.

Referring to Figure 3, a satellite access node 1 comprises a dish antenna 20 mounted for tracking satellites, transmitter and receiver circuits 21 including amplifiers, multiplexers, demultiplexers and codecs, a visited mobile satellite switching centre 22 including a controller 23, a visitor location register 25 and a voice mail box unit 24. The mobile satellite switching centre 22 is coupled for communications signals to the backbone network 2, to a gateway and to the transmitter and receiver circuits 21. The controller 23 is coupled for data signals to the visitor location register 25 and the voice mail box unit 24 and may also send and receive data signals via the backbone network 2.

The controller 23 responds to addresses on incoming communications signals, from the antenna 20, the gateway and the backbone network 2, by controlling the mobile satellite switching centre 22 to output the communications signals on the appropriate paths to their destinations, i.e. the antenna 20, the gateway or the backbone network 2.

The visitor location register 25 maintains a record of each of the subscribers registered with the satellite access node 1. The voice mail box unit 25 provides storage space for voice mail messages for subscribers.

Referring to Figure 4, a database 30, called the home location register, contains records relating to each mobile station 4a, 4b. The record contains the mobile station's identity (International Mobile Subscriber Identity or IMSI) and the current address of the visitor location register 25a, 25b where the mobile station 4a, 4b is registered. The visitor location register 25a, 25b contains a part copy of the home location register information (e.g. which services are subscribed to), the status of the mobile station (whether it is "local" or "global") the geographical position of the mobile station, the address of home location register where the mobile station is a subscriber (to enable billing and other data to be collected at a single point), the currently active satellite access node with which the mobile station is in

communication via a satellite, an individual enciphering key and the address of an associated voice mail box unit location.

5 The home location register 30 may be located in the network management centre 7 (see Figure 1) or may be distributed among the satellite access nodes 1a, 1b, 1c (see Figure 1) or may be in another network, e.g. when a GSM subscriber roams onto the satellite network.

10 Referring to Figures 1 to 4, a mobile station 4a may be registered with one of two distinct statuses; "local" in which the mobile station 4a is permitted to communicate only through one local area or part of the satellite system network, and "global", which entitles the mobile station 4a to communicate through any part of the satellite mobile telephone system.

15 The mobile station 4a performs an automatic registration process (location update), of the kind well known in the art of cellular terrestrial communications, on each occasion when the mobile station 4a is used for an outgoing call, when the mobile station 4a is switched on, periodically whilst the mobile station 4a is operating and when the mobile station 4a has been unpageable for a predetermined period. As is
20 conventional, the location update takes the form of transmitting of a signal identifying the mobile station 4a (e.g. by transmitting its telephone number on a random access channel). The mobile station 4 decides to camp on a particular cell on the basis of measurements of signals on beacon frequencies and the random access channel used is the one associated with the cell on which the mobile station 4 decides
25 to camp.

The transmitted signal is picked up by one of the satellites 3a. From the received random access channel signal, the satellite access node 1a serving the satellite 3a which sets up a dedicated channel for the mobile station 4a. From the random access
30 channel signal, the satellite access node 1a derives the propagation path time and doppler shift and communicates this to the mobile station 4a in an immediate

assignment message. The propagation time is actually send as the difference between actual propagation time and a reference propagation time.

5 The first message sent on the assigned channel by the mobile station 4a is the "initial message" and when this is received the satellite access node 1a, calculation of the mobile station's position using the propagation time and doppler data is triggered. The position of the mobile station 4a is added to the "initial message" which is then passed on to the visitor location register 25a where the mobile station 4a is registered.

10 At this stage, the visitor location register 25a can be used to confirm that the mobile station 4a has a subscription for service in the area for which it is located or conversely when first registering with the visitor location register 25a to use information provided in the initial message to derive the address of the home location register and to contact the home location register during which a part copy of the
15 home location register information will be transferred to the visitor location register 25a and the data in the home location register which points to the visitor location register 25a is updated. The location of the mobile station 4a is thus stored in the database of the visitor location register 25a.

20 As the mobile station 4a and the cells move relative to one another, the visitor location register 25a may determine that the mobile station 4a should be handled via another satellite access node 1b. Consequently, the visitor location register record of the mobile station 4a is amended.

25 When a mobile terminated call is made to the mobile station 4a, it is directed to the visited mobile satellite switching centre 22a at which the mobile station 4a is registered. The visited mobile satellite switching centre 22a causes a paging signal to be sent to the cells where the called mobile station 4a is expected to be, i.e. via the satellites 3a, 3b serving cells covering the mobile station's location. These cells where
30 the mobile station 4a is expected to be are determined from the mobile station's location, stored in the visitor location register 25a, and knowledge of the movement

of cells across the surface of the earth. When the mobile station 4a receives the paging signal, it enters into a dialogue with the network to obtain a channel for the call. If the mobile station 4a does not respond to the paging signal, the network will inform the calling party that the mobile station 4a cannot be reached.

5

When a mobile originating call is to be made, the user of the mobile station 4a enters the number to be dialled and presses a "send" key. The mobile station 4a responds by sending an access request using a random access channel on a dedicated frequency, corresponding to a cell, to the network via one visible satellite 3a, 3b. The satellite
10 access node 1a responds on the basis of the cell from which it receives the access request. The selected satellite access node 1a sends a immediate assignment message using a access grant channel. The immediate assignment message includes the physical parameters of a stand-alone dedicated control channel assigned by the network. The radio link setup is completed using the stand-alone dedicated control
15 channel and then the connection of the call is attempted. On connection of the call, the mobile station 4a is allocated a traffic channel that is then used for the call.

Referring to Figure 5, each TDMA frame 100 transmitted to a cell comprises six time slots. Each time slot of a frame may be occupied by a traffic channel 101, a broadcast
20 control channel slot 102 or an alert channel slot 103a, 103b. When no alert message is being transmitted, no power is radiated during the alert channel slot 103b.

Referring to Figure 6, the first satellite 3a (Figure 1) serves first to seventh cells 301, 302, 303, 304, 305, 306, 307 and the second satellite 3b (Figure 1) serves eighth to
25 fourteenth cells 401, 402, 403, 404, 405, 406, 407. The first cell 301 is surrounded by the second to seventh cells 302, ... , 307 and the eighth cell 401 is surrounded by the ninth to fourteenth cells 402, ... , 407. The eighth to fourteenth cells 401, ... , 407 overlap with the first to seventh cells 301, ... , 307. The ground track of the first satellite 3a is indicated by arrow A and the ground track of the second satellite 3b is
30 indicated by arrow B. A mobile station 4 is located in the first cell 301 towards its

leading side. It can be seen that the neighbouring cells of the first cell are the second to seventh cells 302, ... , 307 and the eighth to eleventh cells 401, ... , 404.

5 Referring to Figure 7, a short time later, the footprints of both satellites 3a, 3b have moved across the earth's surface. Assuming for the sake of this explanation that the mobile station 4 has not moved relative to the earth's surface, it can be seen that the mobile station is more centrally located in the first cell 301 and that the neighbouring cells of the first cell are now the second to seventh cells 302, ... , 307, as before, and the eighth to fourteenth cells 401, ... , 407 which virtually match the positions of the
10 first to seventh cells 301, ... , 307.

Referring to Figure 8, considering now the situation where the mobile station 4 is switched on when positioned as shown in Figure 6, the mobile station 4 initially scans all broadcast control channel frequencies (step s1) and determines which has the
15 best signal (in the present example this will be assumed to be the first cell 301) (step s2). It then transmits a location update signal in a random access channel of the first cell 301 (step s3).

The mobile station 4 decodes the all of the control information in the broadcast
20 control channel of the first cell 301 including the whole of the neighbouring cell data (step s4). The neighbouring cell data is transmitted by the network (step s101) in the broadcast control channel in two discrete blocks, a first one relating to the neighbouring cells served by the first satellite 3a and a second one relating to the neighbouring cells served by the second satellite 3b. Once the broadcast control
25 channel information has been decoded, the mobile station 4 ceases to decode the first block of neighbouring cell data transmitted in the broadcast control channel. However, the mobile station 4 will monitor the alert channel (step s5). Under unchanging circumstances, no power is radiated in the alert channel slots by the network and consequently, the mobile station's controller does not need to process
30 any information.

The mobile station 4 periodically decodes the second neighbouring cell data block (step s6) and measures the beacon frequencies identified by its neighbouring cell list and the beacon frequency of the cell 301, on which it is camped, to determine whether it should camp on another cell (step s7).

5

When the footprints of the satellites 3a, 3b move into the relation shown in Figure 7, the neighbouring cell data relating to cells served by the first satellite 3a remains valid but the neighbouring cell data relating to the cells served by the second satellite 3b is no longer valid. Consequently, the network modifies the transmitted neighbouring cell data in the second neighbouring cell data block (step s101) and this is decoded by the mobile station 4 (step s6). At this time, the first neighbouring cell data block is not decoded.

10

Under normal circumstances, the mobile station 4 will only need to decode the first neighbouring cell data block once when it first camps on a cell. However, the beacon frequencies of one or more of the cells (301, ..., 307) covered by the first neighbouring cell data block may change, for instance because the cells are moving into an area with different spectrum allocation regulations. In this situation, an alert message is transmitted (step s102). The mobile station 4 receives the alert information (step s5) which is decoded by the mobile station's controller (step s8). The controller determines that there has been or will be a change in the first neighbouring cell data block in the control information and controls the mobile station 4 to start to decode those broadcast control channel bursts containing the first neighbouring cell data block (step s9). The controller then updates the neighbouring cell list (step s10) and uses the modified list to control subsequent measurements of beacon signals (step s7). The mobile station 4 continues to repeatedly check for an alert message and decode the second neighbouring cell data block.

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When the mobile station 4 determines that it should camp on another cell, it will know the broadcast control channel frequency for the new cell because it will have been provided in the neighbouring cell data. As mentioned above, the mobile station

30

4 initially decodes all of the neighbouring cell data from the new broadcast control channel and then operates as described above; monitoring the alert channel and then only decoding the first neighbouring cell data block when a change therein is indicated by a signal in the alert channel.

5

In the foregoing description, each satellite serves seven cells. This is fewer than would be likely in practice. However, the small number of cells has been used in order that the present invention may be more easily understood.

- 10 In another embodiment, the neighbouring cell data is divided into three blocks. A first block is substantially static and relates to cells served by the a first satellite. A second block changes relatively slowly and relates to cells served by a second satellite in the same orbital plane as the first satellite. A third block changes relatively rapidly and relates to cells served by a third satellite in an orbital plane different to that of the
- 15 first satellite.

- When a mobile station 4 first camps on a cell, it decodes all of the neighbouring cell data in the broadcast control channel. Thereafter, it repeatedly decodes the third block and only decodes the first and second block on receipt of characteristic alert
- 20 messages.

- The foregoing description uses terminology familiar to the skilled person from descriptions of GSM systems in order to make the present invention more readily comprehensible. However, the present invention is not limited to systems similar to
- 25 GSM systems.

Claims

1. A method of operating a mobile station in a satellite mobile telephone system, the method comprising the steps of:
 - 5 decoding all of a set of neighbouring cell data transmitted in a broadcast channel to generate a neighbouring cell list;
 - making signal measurements for the cells in said list and the current serving cell;
 - decoding a portion only of the set of neighbouring cell data transmitted in the broadcast channel and modifying the neighbouring cell list in dependence thereon;
 - 10 and
 - making signal measurements for the cells in said list and the current serving cell.
- 15 2. A method according to claim 1, including the steps of decoding a further portion of said set on reception of a decode instruction in the broadcast channel and modifying the neighbouring cell list in dependence thereon.
3. A method according to claim 2, wherein the data in said portion changes more
20 rapidly than the data in said further portion.
4. A method according to claim 1, 2 or 3, wherein the neighbouring cell data comprises information identifying a beacon frequency for each cell.
- 25 5. A method according to any preceding claim 1, 2 or 3, including:
 - comparing said measurements; and
 - if the best measurement is not for the currently serving cell, camping on the cell to which the best measurement applies.
- 30 6. A mobile station for a satellite mobile telephone system, the mobile station comprising transceiver means and control means, wherein the control means is

programmed so as to cause the mobile station to operate according to any preceding claim.

- 5 7. A method of operating a mobile satellite telephone system comprising the steps of:

transmitting neighbouring cell data in a broadcast channel, the neighbouring cell data comprising a first portion relating to cells served by a first satellite in an orbit having a first plane and a second portion relating to cells served by a second satellite in an orbit having a second, different plane; and

- 10 transmitting neighbouring cell data in the broadcast channel, the second part of the cell data being modified in dependence on the relative motion of the first and second satellites.

- 15 8. A method according to claim 7, wherein the neighbouring cell data comprises information identifying a beacon frequency for each cell.

9. A method according to claim 8, including transmitting a decode instruction when data in the first portion of the cell data is modified.

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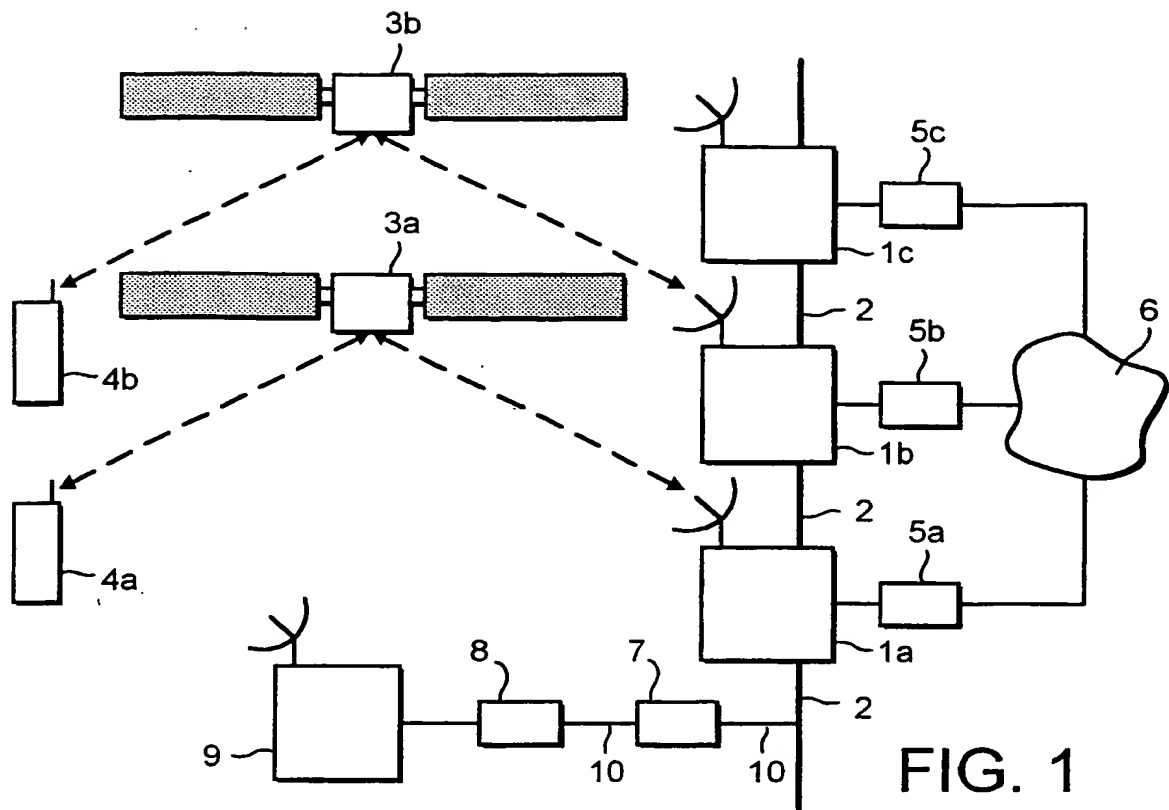


FIG. 1

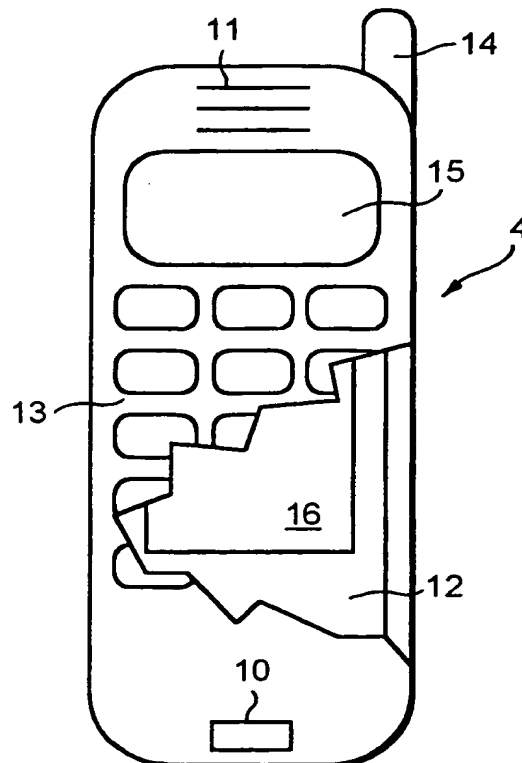
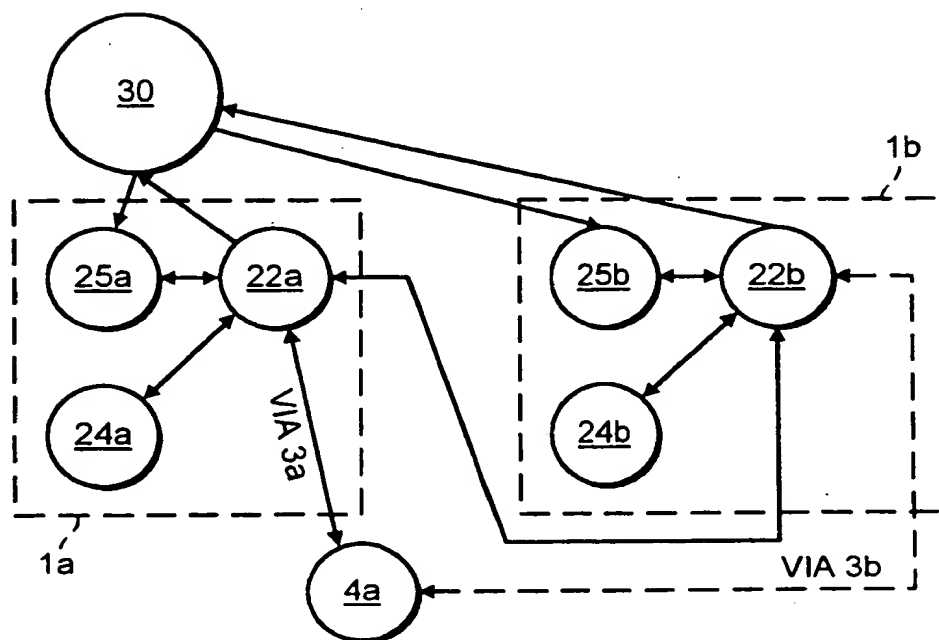
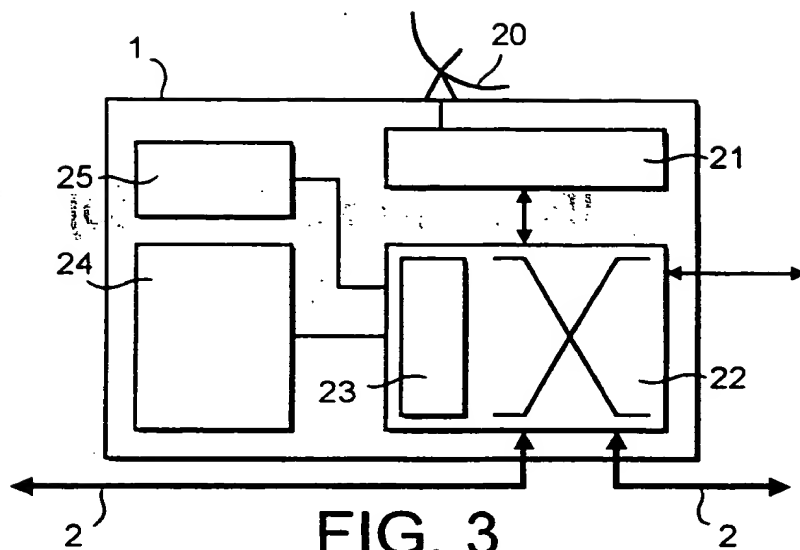


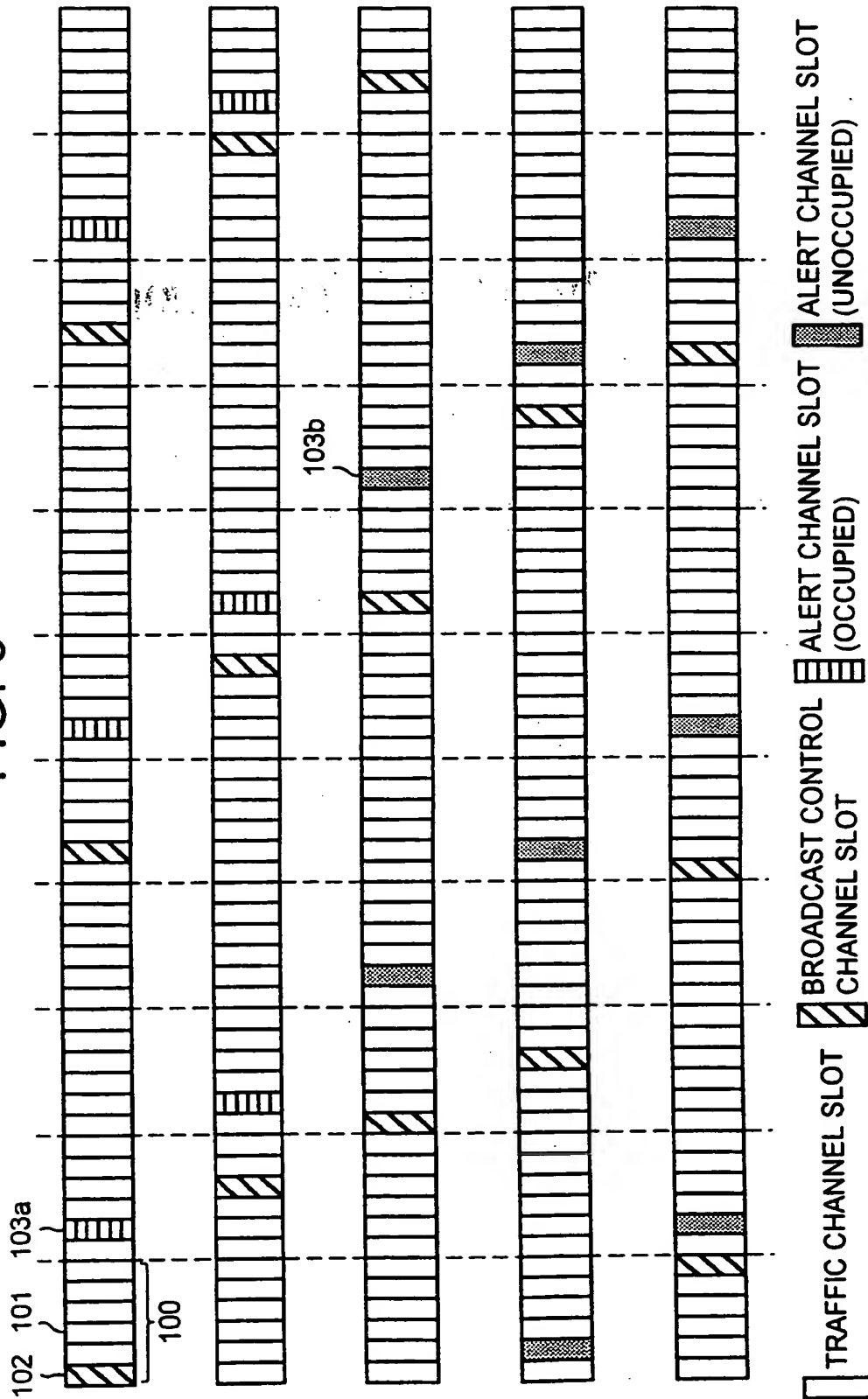
FIG. 2

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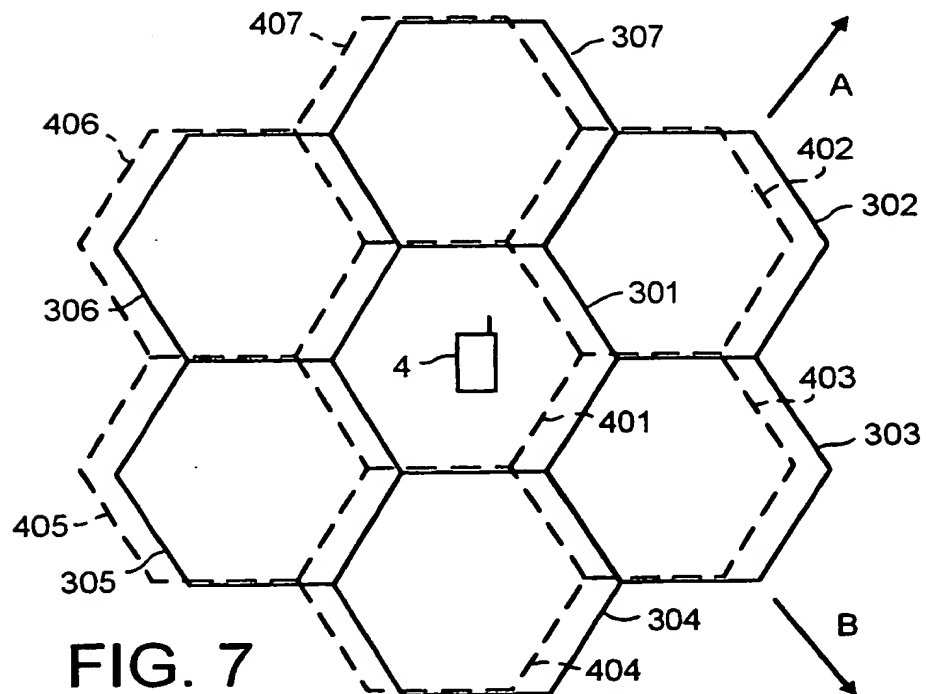
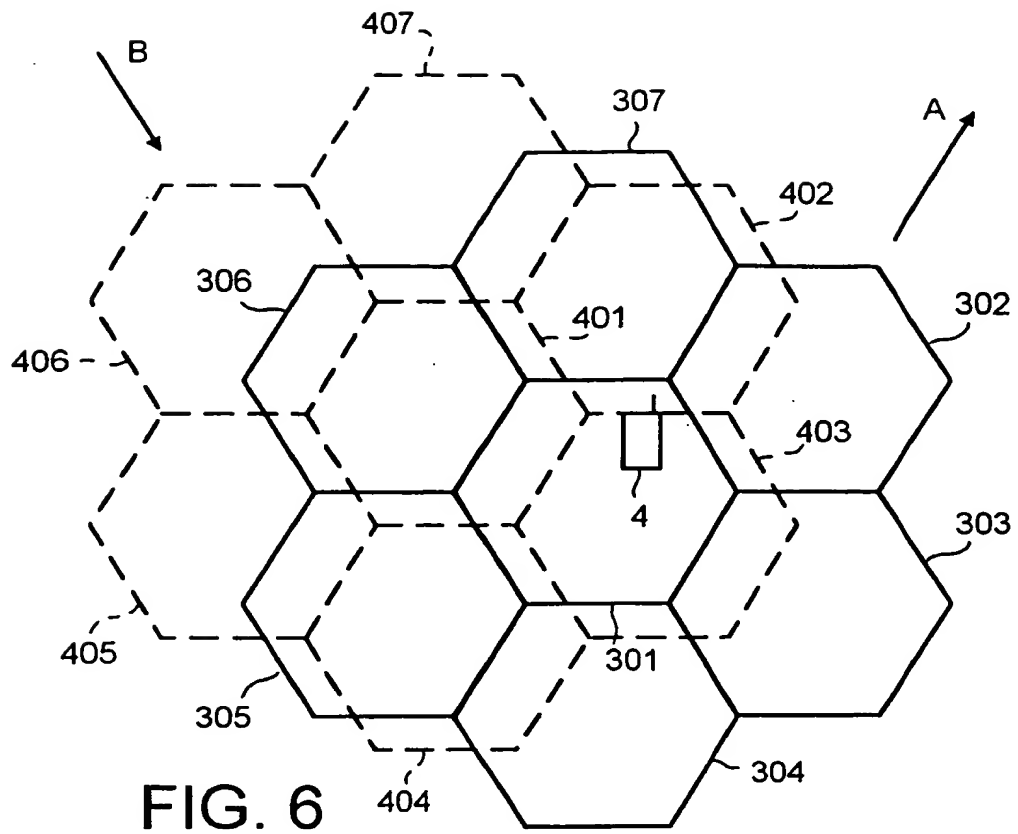


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FIG. 5



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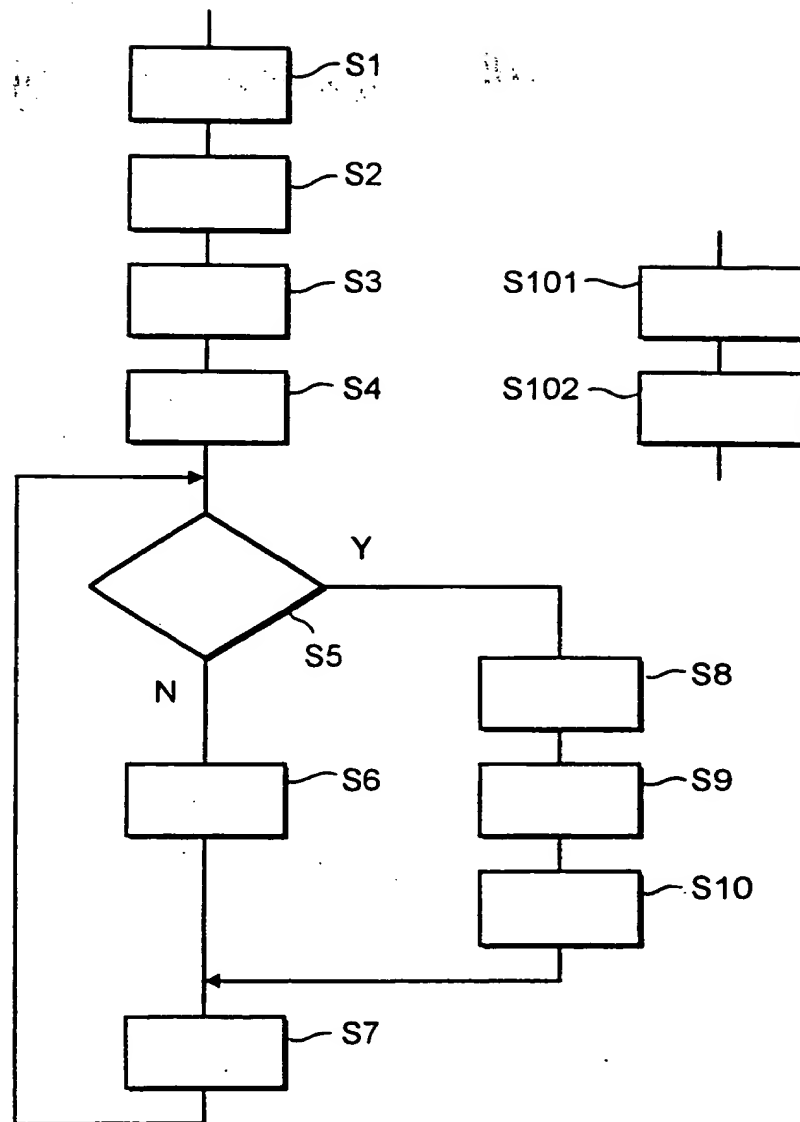


FIG. 8

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INTERNATIONAL SEARCH REPORT

International Application No

PC 00/00725

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B7/185

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96 13946 A (MOTOROLA) 9 May 1996 (1996-05-09) claims 1-10; figure 2	1-9
A	GB 2 303 764 A (INMARSAT) 26 February 1997 (1997-02-26) claims 1-52	1-9
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A	US 5 412 389 A (MOTOROLA) 2 May 1995 (1995-05-02) column 2, line 19 - line 55; figures 1-10	1-9

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the International search

4 April 2000

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Bischof, J-L

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PO 00/00725

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